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Quaternary alluvial deposits of Wadi Gaza in the middle of the Gaza Strip (Palestine): Facies, granulometric characteristics, and their paleoflow direction

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ABSTRACT

The Quaternary rocks of the Gaza Strip mainly consist of clastic sedimentary rocks. In Wadi Gaza, the outcropping rocks consist of brownish fine-grained deposits, sandstones, and conglomerates. The deposits have been studied from a genetic point of view, and six facies have been described: (i) graded clast-supported conglomerates, (ii) cross-bedded clast-supported conglomerates, (iii) sandy matrix conglomerates, (iv) cross-laminated medium-grained sandstones, (v) graded coarse-grained sandstones, and (vi) massive sandstones. The field work observations and granulometric analysis show that the sphericity of the grains increase toward the west, where its value ranges from ~0.64 in the east to ~0.70 in the west. In addition, the grain forms tend to be disc shape in the east, whereas they tend to be disc-to spheroid shape in the west, and they become well rounded to well sorted toward the west. Moreover, the features, geometry, and spatial relationship among these facies suggest that the Wadi Gaza was meandering wadi fed from Beir Sheva and the Northern Negev in the southeast of Gaza Strip through Wadi Al Shallala and Wadi Sheneq and from Hebron mountains in the West Bank at the east through Wadi Al Shari'a alluvials. Within the Gaza Strip, paleocurrent data ranges from 210° to 310°, indicating a mean a paleoflow direction to the W (276°) and a median value about 275°. The sedimentary rocks in the Wadi Gaza are considered to be deposited in two periods of climate conditions: the coarse-grained rocks were deposited during the period of wet condition before 12.4 ka age, whereas the eolinite fine-grained rocks were deposited during semiarid climate conditions which are younger in age than 12.4 ka.

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1. Introduction

The form of the alluvial river channel reflects the range of environmental factors that determine erosion, transportation, and deposition of unconsolidated debris by the river itself. An understanding of the interaction of these factors is important for the analysis of the response of the modern rivers human perturbation and for the interpretation of ancient fluvial deposits. However, the relationships between the hydraulic and sedimentary controls of the form of an alluvial channel have attracted a lot of sedimentologists (e.g., Hack, 1960; Barker and Pyne, 1978; Leopold, 1980). More recently, Paola et al. (1992) and Paola and Seal (1995) have made important advances in their consideration of general system of equations that describe the transport in gravel-bedded stream as it relates to the evolution of the alluvial basin fill and the downstream distribution of grain size.

Particle morphology, or form, refers to the sum of the surface characteristics of sedimentary grains. The process of weathering, erosion, and transport may leave distinctive imprints on particles, worn surfaces, and particular surface textures. Thus, morpholometrical analysis can offer, along with granulometric and petrographic analyses, relevant information on the sediment source, transport environment, and sedimentation process (Bridgland, 1986; Illenberger and Reddering, 1993; Graham and Midgley, 2000; Stanley and So, 2006; Lindsey et al., 2007; Ehlmann et al., 2008; Tamrakar and Shrestha, 2008; Mureşan, 2009; Hurst et al., 2010).

Wadi Gaza is located in the centre of the Gaza Strip, and it crosses the Strip from east to west. The wadi's length from origin to mouth is about 105 km, where the last 9 km of it is located in Gaza Strip. Its watershed is estimated to cover around 3600 km^2 in Gaza Strip and neighbouring areas beyond the armistice border (Ubeid, 2013). The light-brown paleosols of the Pleistocene–Holocene

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cover most of wadi's area (Ubeid, 2011a). The sandy and gravelly deposits crop out in few locations because of excavation of gravels for construction purposes.

The Wadi Gaza lacks sedimentological studies. In this study the aims are to identify the lithofacies of the Wadi Gaza, focusing on the coarse-grained deposits. Granulometric and petrographic analysis have been done in this study to identify the characteristic of coarse-grains especially the form- and grain-shape, in order to infer the sediment source origin, transport environment and sedimentation process in Wadi Gaza. Moreover, the paleoclimate has been deduced from the sediment types and successions in the wadi.

1.1. Background information/geology

The Gaza Strip constitutes the south-western part of Palestinian coastal plain between 34° 2′ and 34° 25′ East and 31° 16′ and 31° 45′ North. The Gaza Strip is confined between the Mediterranean Sea in the west, the Sinai Desert of Egypt in the south and the Negev Desert in the east (Fig. 1). It covers an area of ~365 km^2 and has length of 45 km between Beit Hanoun in the north to Rafah in the south. Its width ranges from 6 to 8 km in the central and northern regions to maximum of 12 km in the south.

The topography of Gaza Strip is defined by three elongated ridges: The Coastal Ridge, Al-Montar Ridge, and Bit Hanoun Ridge, these are known as Kurkar Ridges. The age of these ridges increase from the coastline eastward. The ridges are built of several sedimentary cycles, which are intercalated by red sandy loam soils locally termed hamra (Arabic word for red). The ridges are separated by deep depressions (20–40 m above main sea level) with alluvial deposits. The ridges and depressions generally extend in a NNE-SSW direction, parallel to the Mediterranean coastline. The Coastal Ridge is up to 50 m above main sea level, it extends up to the current coastline in the west. At the middle lays the Al-Montar Ridge which is up to 80 m above main sea level. The third ridge is Beit Hanoun Ridge partially running along the armistice line in the east (Ubeid, 2010).

The Wadi Gaza is one among the three main wadis that dissected the Gaza Strip. It crosses the centre of Gaza Strip from east to west. The wadi's length from origin to mouth in the Mediterranean Sea is about 105 km, where the last 9 km of it is located in Gaza Strip. The watershed of the wadi is estimated to cover 3600 km^2 of the northern Negev Desert and Hebron Mountains as well as the small catchment in Gaza. The Wadi Gaza has rarely flowed during the past several decades, due to numerous water diversion and storage projects upstream in Israel.

Geologically, the Late Pleistocene to Holocene sedimentary sequences in the coastal plain of Palestine accumulated only in the troughs between longitudinal, north-south, Late Pleistocene,

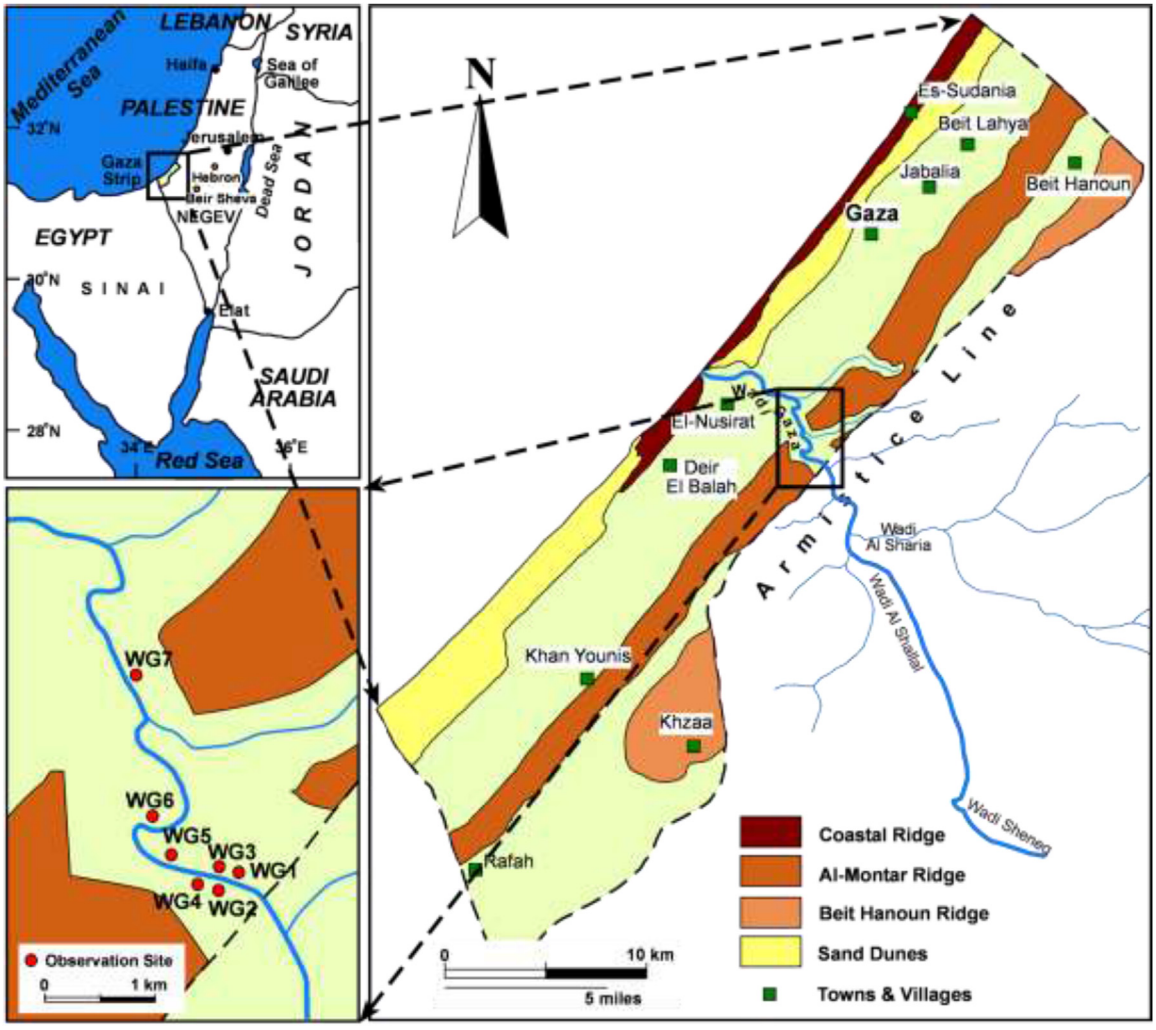

Fig. 1. Location map of Gaza Strip, it shows the Wadi Gaza in the middle part (After Ubeid, 2013).

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